REMARKS

By this amendment, claims 1-4 and the specification have been revised and new claims 9-12 are added to place this application in condition for allowance. Currently, claims 1-8 are before the Examiner for consideration on their merits.

The specification has been revised to correct errors in the printing of the inequalities in the formula and the temperature "°C."

Each of claims 1-4 has been revised to include Cu as an alloying element of the claim, leaving Mo still optional. This amendment is permitted since the claims originally called for at least one of either Cu or Mo, and reciting that the at least one element is Cu is permitted. New claims 9-12 are added to cover the embodiment that Mo is present.

In essence, the Examiner has relied on four prior art references to reject the claims, United States Patent Nos. 6,576,186 to Martin, 6,793,744 to Jung et al. (Jung), JP 2-243740 to Kunio and JP 6100935 to Takuya. Certain dependent claims are also rejected based on the contention that employing small amounts of Ca, REM, B and/or Mg in the alloys of the primary references is obvious. The rejections are traversed in under the headings of the Invention and the applied prior art.

INVENTION

The invention is an improvement in the field of 13% Cr alloy steels. These steels are typically processed by hot working, quenching and tempering. The problem with these steels is the precipitation of carbides along the grain boundaries. This carbide precipitation occurs during the tempering step and causes a reduction in corrosion resistance. In spite of this problem, tempering of the steel is done in order to obtain sufficient resistance to sulfide stress corrosion cracking.

The inventors have discovered that eliminating the high temperature tempering step so that the steel defined in claim 1 is used in the hot finished, quenched or low temperature tempered condition results in unexpected improvements in steel quality. That is, the amount of carbides is greatly reduced, and the steel has excellent corrosion resistance. This result is achieved by the following:

1) A mixture of at least Cu sulfide and also Mo sulfide, which is generated by adding Cu and optionally Mo in combination to form a tight film onto the film of Cr oxides and protect the

film of Cr oxides, thus obtaining resistance to sulfide stress corrosion cracking.

2) Since any $M_{23}C_6$ type carbide is hardly present in the hot-finished condition or in the quenched condition, the resistance to sulfide stress corrosion cracking is enhanced. This suppression of the precipitation of the $M_{23}C_6$ is attained in one mode by the elimination of the tempering treatment.

3) Controlling the hardness within the proper range enhances the corrosion resistance.

MARTIN

In the rejection, the Examiner relies on Martin to reject claims 1-8. The Examiner takes the position that since Martin shows a similar composition, the hardness and other properties would be present in the alloy of Martin. Regarding the limitation of carbides, the Examiner contends that such a result would be expected in Martin, or alternatively that the result of the carbide concentration carries no patentable significance since it refers to an intermediate property.

First, it is contended that Martin is directed to a completely different type of steel than the invention. Martin is a precipitation hardening stainless steel as is evident from the title and Abstract. See also col. 3, lines 4-16, wherein Cu is described as an element contributing to the precipitation hardening via the age hardening treatment.

This is clearer when considering Tables III and IV of Martin. In Table IV, the material is subjected to an age hardening treatment wherein the temperature ranges from 900 to 1150°F in order to obtain remarkable improvements in 0.2% offset yield strength as well as ultimate tensile strength.

In fact, Martin is really concerned with improving the free machinability of alloy compositions used for fracture-critical components, see col. 1, lines 45-47. Martin solves this problem via the control of the sulfur content, see col. 2, lines 45-50. In contrast, the present invention is concerned with improving the corrosion resistance and resistance to sulfide stress corrosion cracking.

Moreover, the mere fact that Martin may present a range of compositions that overlap that claimed does not end the question of patentability. The rejected claims also require a certain level of hardness, meeting the claimed formulas, and the particular level of carbides claimed.

While the Examiner alleges that these features are present in Martin by virtue of the closeness in composition and processing, this conclusion is refuted by the comparative evidence

set forth in the specification. Referring to Table 3, Test Nos. 10, 18, and 24, it is evident that having the same composition of materials does not result in the claimed hardness and carbide levels. These tests show that the processing is critical to the end product. Test No. 26 also shows that the formula of claims 2 and 4 is critical, since if the lower limit of the formula is not met, even with a processing that is effective for alloys within the claimed ranges, i.e., the AC processing, improvements in corrosion resistance and sulfide stress cracking corrosion resistance are not achieved.

What this comparative testwork says is that the alloy product of claims 1-8 is not taught in Martin since Martin does not teach a method of processing that would result in the claimed hardness and carbide amount.

Lastly, Applicants contend that the Examiner cannot ignore the limitation regarding carbide content since it is clearly a measurable parameter as shown in Table 3 and page 14, lines 8-16. The effect of the carbide content at the prior austenite stage is evident in the improvements in corrosion and sulfide stress cracking resistances, and Applicants should be entitled to claim this feature to distinguish the invention from the prior art. In addition, grain boundaries of prior austenite can be elucidated in the metallurgical structure of the final product, so the contention that Applicants are somehow claiming a structure that is not present is incorrect. If the Examiner maintains this position, it is respectfully requested that supporting evidence be presented to buttress any further contention that Applicants are not entitled to claim the carbide concentration as presently set forth.

Moreover, there is no motivation to modify Martin to have a processing that would result in the claimed alloy end product. Any such contention is the hindsight reconstruction of the prior art in light of Applicants' own disclosure and not permitted under current patent case law.

In addition, the improvements discovered by the invention, i.e., discovering that both corrosion resistance and sulfide stress cracking resistance are improved when using the claimed alloy with the claimed properties is totally unexpected in the art and deserving of patent protection.

The secondary reference to Miyakusa does not supply the deficiencies in Martin. Miyakusa relates to a stainless steel with a duplex structure of martensite and ferrite and having a controlled composition to eliminate or reduce edge cracking. To accomplish the aims of Miyakusa, C and N are controlled as inexpensive austenite formers and martensite strengtheners. Heat treatment is also a critical aspect of this reference in order to obtain the required high

strength and good corrosion resistance. and an object of this patent is to prevent the generation of edge cracking. To prevent edge cracking, Miyakusa controls the B content. It is plain to see that Miyakusa does not teach the invention or even supply any motivation to modify Martin so as to arrive as the invention. Thus, the presence of this reference cannot support a *prima facie* case of obviousness with Martin.

It is respectfully submitted that Martin, alone or with Miyakusa does not establish a *prima facie* case of obviousness against claims 1-8, if any obviousness is alleged, it is rebutted by the invention, and the rejection should be withdrawn.

JUNG

Jung is similar to Martin in that it is directed to a problem that is entirely different from the one faced by the instant inventors. Jung is concerned with the problem in the prior art that steels do not have a combination of high strength and high corrosion resistance. Jung overcomes this problem by using W as an essential element of the composition, and utilizes the effect of M_2C precipitation on high temperature mechanical properties so as to improve tempering and pitting resistances. In addition, Cu is employed to improve corrosion resistance as the hardenability against high temperature steam by improving the fine grain size by precipitating a kind of Cu compound, see col. 4, lines 5-11.

As importantly, the heat treatment is a necessary part of the aim of Jung. Referring to col. 4, lines 36-40 and Fig. 1, precipitation hardening by tempering at 350-575°C is taught. Claims 5-8 of Jung also teach that after the austenitization treatment at 800-1150°C, tempering at 350-575°C is performed.

While Jung does discuss the minimization of $Cr_{23}C_6$ in the claims, Jung achieves this through composition control. That is, C is limited as described in col. 3, lines 7-14 and Ni is intentionally added as detailed in col. 4, lines 12-23. There is no description or implication of suppressing $Cr_{23}C_6$ via heat treatment as is done in the present invention.

In light of the above, it is argued that Jung does not teach or suggest the claimed steel as set forth in claims 1-4. As explained above for Martin, merely having a composition that falls within the claimed range does not mean that the claimed hardness and carbide content are met. Jung fails like Martin since there is no basis for the Examiner to conclude that the steel and its characteristics are found in the alloy of Jung.

As also pointed out above, the invention uses Cu and optionally Mo in the claimed

formulation and a specific heat treatment to obtain the claimed hardness and carbide content and Jung does not teach this invention whatsoever.

The arguments made regarding inherency, obviousness, and unexpected results under the MARTIN heading are incorporated by reference with respect to Jung, and these arguments are further substantiation that the rejection based on Jung is improper.

Thus, the rejection of claims 1-4 based on Jung is flawed and should be withdrawn.

KUNIO

The Examiner relies on Kunio to reject claims 1-4 under 35 U.S.C. § 102(b). Since Kunio defines a copper-free alloy and claims 1-4 have been revised to include Cu as an alloying element of the steel, Kunio cannot anticipate claims 1-4, as amended. Moreover, there is no basis to conclude that Kunio somehow renders obvious claims 1-4 since copper is not even contemplated as an alloying element of the steel of Kunio. Any allegation of obviousness can only be the hindsight reconstruction of the prior art in light of Applicants' own disclosure.

In light of the amendments to claims 1-4, the rejection based on Kunio must be withdrawn.

TAKUYA

Takuya is relied upon by the Examiner to reject claims 1 and 2 under 35 U.S.C. § 103(a). In this rejection, the Examiner contends that the properties of hardness and carbide content would be expected and references the Abstract of Takuya to contend that a low temperature tempering treatment is contemplated.

Applicants submit herewith a translation of paragraph [0020] of Takuya for the Examiner's benefit. In this translation, Takuya teaches that the tempering shall be conducted at the temperature where the supersaturated carbon atom can be precipitated as carbide. Takuya cannot be interpreted to teach a low temperature tempering that would hardly permit the diffusion of substantial alloying elements. In fact, when viewing Table 1 of Takuya, the tempering temperature falls within the range of 560-680 °C, all being above the 400 °C so-called high temperature tempering minimum, see the specification, page 15, lines 10-15.

With tempering temperatures in the range noted above, Takuya is merely representative of the prior art and its problems with carbide precipitation at the grain boundaries of the prior austenite. The Examiner cannot conclude based on the broad Abstract disclosure that the heat

treatment of Takuya would produce the claimed properties and carbide content in light of the translation supplied herewith.

Moreover, the specification indicates that the contemplated heat treatment of Takuya would not produce the claimed steel. Referring to Table 2 and Nos. 10, 18, and 24, even alloys falling within the claimed ranges that are heat treated at high temperatures fail to have the claimed hardness and carbide concentration. Thus, the Examiner cannot conclude that the steel of Takuya meets the limitations of claims 1-4. Accordingly, the Examiner has no choice but to withdraw the rejection of claims 1 and 4 based on Takuya.

While the Examiner combines Takuya with Kunio to reject claims 5-8, Kunio is not relevant to the copper containing steels of the invention, and not even properly combined with Takuya. Even if still fails to make up for the deficiency in Takuya, and even if properly combined, the invention of claims 1-4 is still not taught.

SUMMARY

To recap, Kunio has been removed as a reference on the basis that is lacks copper as an alloying element. Martin, Jung, and Takuya are also removed as references on the grounds that none of these references teach the claimed composition, hardness level, formula, and level of carbide content. Each of these references has different processing and the comparative evidence set forth in the specification precludes the Examiner from asserting that just the similarity in composition produces the claimed properties and carbide content. Moreover, the unexpected benefits associated with the invention are further evidence that the prior art does not obviate the invention.

Accordingly, the Examiner is respectfully requested to examine this application and pass claims 1-8 onto issuance.

If the Examiner believes that an interview with Applicants' attorney would be helpful in expediting prosecution of this application, the Examiner is respectfully requested to telephone the undersigned at 202-835-1753.

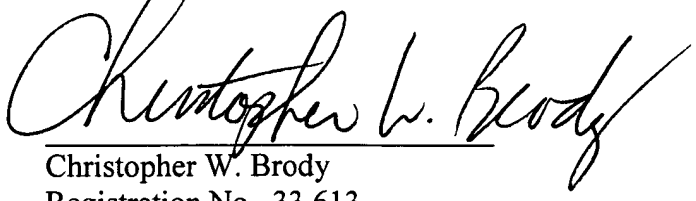
The above constitutes a complete response to all issues raised in the Office Action dated August 8, 2005.

Again, reconsideration and allowance of this application is respectfully requested.

A one-month extension of time is respectfully requested. A check in the amount of $120.00 is attached for the extension of time fee, however, please charge any fee deficiency or

credit any overpayment to Deposit Account No. 50-1088.

Respectfully submitted,
CLARK & BRODY



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